Learn:

- The definition of pressure. (**P=F/A**)
- Pascal's principle. ($F_1/A_1=F_2/A_2$)
- Boyle's law and the ideal gas law. ($P_1V_1=P_2V_2$)
- Archimides' principle. ($F_B=\rho Vg$, Buoyant force=Weight of fluid displaced)

Understand:

- The origin of atmospheric pressure.
- How the height of a column of liquid such as mercury can be used to measure pressure.
- How the pressure of a column of fluid depends on the height and the density of the fluid. $P = \rho hg$
- The use of Boyle's law and the ideal gas law.
- How Archimedes' principle determines whether an object floats or sinks in a fluid.

Pressure

- **Pressure** describes the concentration of a **force**.
- Increasing surface area spreads out the force and reduces pressure. Increasing the force on a surface increases the pressure on that surface.
- Pressure equals force per unit area

P=F/A

- Standard Unit for pressure is called Pascal and is equal to Newton/(meter)^2 in symbol:

1Pa=1 N/m^2

- Pounds per square inch (PSI) is a commonly used pressure unit that literally states the definition (see the car tires).

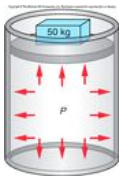
1PSI=1 lb/in^2

Snow Shoes

- Snow shoes are very wide. They keep you from sinking into the snow by reducing the pressure you put on the snow with each step.
- You do not weigh less when you put on snow shoes, but the force of your **weight*** is spread over a much wider area so that there is less pressure.

Pascal Principle

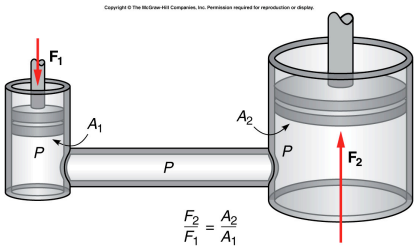
- Pascal's law states that when there is an increase in pressure at any point in a confined fluid, there is an equal increase at every other point in the container.



- Pressure equals force per unit area, then it follows that

P=F1/A1 = F2/A2

Hydraulic Jacks



- Pressure is the same throughout therefore force larger in larger piston

Fluid Pressure

- Pressure will be the vertical force (weight) divided by the area (P=F/A)
- The volume of the tube is the product of its area with its height (V=ah)
- The density ρ is the mass divided by volume (ρ =m/V). ($\rho = 10^3$kg/m3 for water and 13.6×10^3kg/m3 for Hg)
- Using all this we can write:

$P = F/A = mg/A$

$P = \rho Ahg/A$

$m = \rho V = \rho Ah$

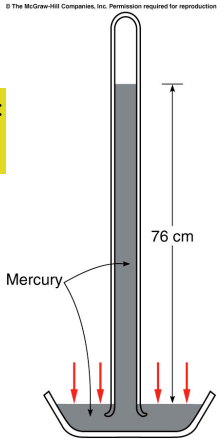
$P = \rho hg$

Atmospheric Pressure

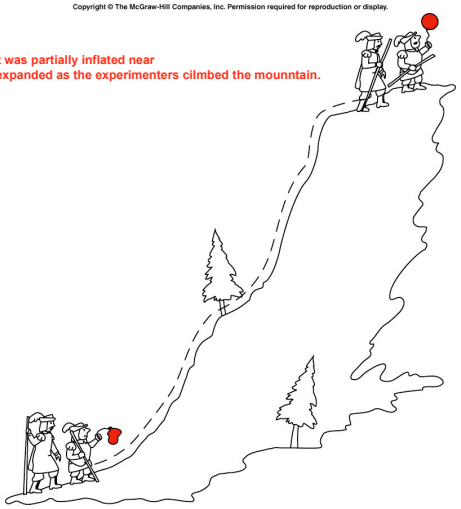
Atmospheric pressure is defined as:
1 atm = 76 cm Hg = 1.01 10^5 Pa

How high would water rise in a closed inverted column, at 1 atm?

The pressure at the base of the water column, ρgh, is 1 atm:
1.01 10^5 Pa = (10^3kg/m3)(9.8m/s2)(h);
thus h=10.3 m

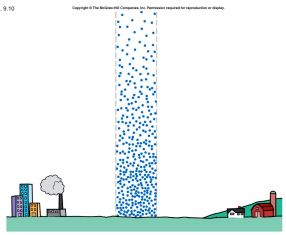


A balloon that was partially inflated near the sea level expanded as the experimenters cilmbed the mounntain.



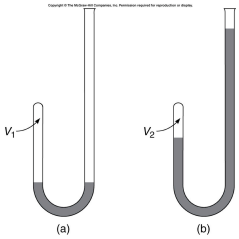
Boyle's Law: How does the volume of a gas change with pressure?

Fig. 9.10



The density of a column of air decreases as the altitude increases because air expands as P decreases

Fig. 9.12



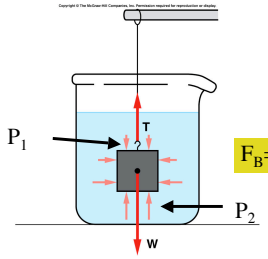
In Boyle's experiment, adding mercury to the open size of the bend tube caused a decrease in the volume of the trapped air in the closed side

Boyle's Law: $P_1V_1 = P_2V_2$

Archimides' principle and Buoyant force.

(F_B=r Vg, Buoyant force=Weight of fluid displaced)

Fig. 9.15



$F_B=(P_2-P_1)A = r_f g(h_2-h_1)A = r_f gV$

r_f if the density of the fluid

The pressure acting on a bottom of the suspended metal block is greater than that on the top due to increase of pressure with depth